

What is claimed is:

- [Claim 1]** A glass or glass-ceramic sealant composition comprising:
a glass constituted from a mixture of alkali-free inorganic oxides, the mixture including, on a mole basis, 20 to 50 % BaO, 1 to 10% Y₂O₃, 5 to 20% B₂O₃, 10 to 30% SiO₂, 3 to 35% MgO, 2 to 20% CaO, 1 to 10% ZnO, and 0 to 5% ZrO₂.
- [Claim 2]** A composite sealant composition comprising:
a glass component constituted from a mixture of alkali-free inorganic oxides; and
a filler component dispersed in the glass component, said filler component being up to 40% by weight of the composition.
- [Claim 3]** The composition of claim 2, wherein the glass component comprises, on a mole basis, 20 to 50 % BaO, 1 to 10% Y₂O₃, 5 to 20% B₂O₃, 10 to 30% SiO₂, 3 to 35% MgO, 2 to 20% CaO, 1 to 10% ZnO, and 0 to 5% ZrO₂.
- [Claim 4]** The composition of claim 1, wherein the glass component comprises on a mole basis 25 to 35% BaO.
- [Claim 5]** The composition of claim 1, wherein the glass component comprises on a mole basis 1 to 3% Y₂O₃.
- [Claim 6]** The composition of claim 1, wherein the glass component comprises on a mole basis 14 to 18% B₂O₃.
- [Claim 7]** The composition of claim 1, wherein the glass component comprises on a mole basis 15 to 25% SiO₂.
- [Claim 8]** The composition of claim 1, wherein the glass component comprises on a mole basis 10 to 20% MgO.
- [Claim 9]** The composition of claim 1, wherein the glass component comprises on a mole basis 10 to 18% CaO.
- [Claim 10]** The composition of claim 1, wherein the glass component comprises on a mole basis 1 to 3% ZnO and 1 to 2% ZrO₂.

[Claim 11] The composition of claim 2, wherein the filler component is non-metal.

[Claim 12] The composition of claim 2, wherein the filler component comprises zirconia, alumina, barium titanate, strontium titanate, or a combination thereof.

[Claim 13] The composition of claim 2, wherein the filler component comprises yttria-stabilized zirconium oxide.

[Claim 14] The composition of claim 13, wherein the filler component further comprises barium titanate.

[Claim 15] . The composition of claim 2, wherein the glass component and the filler component are mixed with a binder system which comprises one or more thermoplastic polymers.

[Claim 16] The composition of claim 15, which is in the form of a tape.

[Claim 17] The composition of claim 2, wherein the glass component upon heating to a temperature above its softening point devitrifies and crystallizes to transform the glass component into a glass-ceramic matrix in which the filler component is dispersed, thus forming the composite sealant material.

[Claim 18] A composite sealant composition comprising:

a glass component including, on a mole basis, 25 to 35 % BaO, 1 to 3% Y₂O₃, 14 to 18% B₂O₃, 15 to 25% SiO₂, 10 to 20% MgO, 10 to 18% CaO, 1 to 3% ZnO, and 1 to 2% ZrO₂; and

a filler component dispersed in the glass component, said filler component being up to 40% by weight of the composition.

[Claim 19] The composition of claim 18, wherein the filler component is selected from the group consisting of zirconia, alumina, barium titanate, strontium titanate, and combinations thereof.

[Claim 20] A solid oxide fuel cell stack comprising:

a first structural component;

a second structural component; and

a sealant composition disposed between and contacting the first component and the second component, wherein the sealant composition comprises a glass component which comprises a mixture of alkali-free inorganic oxides; and a filler component dispersed in the glass component, said filler component being up to 40% by weight of the composition.

[Claim 21] The fuel cell stack of claim 20, wherein the first component is a first fuel cell and the second component is a separator plate.

[Claim 22] The fuel cell stack of claim 20, wherein the first component is a stack of two or more fuel cells and the second component is a manifold for directing fuel and oxidant into and out of the stack.

[Claim 23] A process for sealing a fuel cell stack, comprising the steps of:

forming a composite sealant mixture comprising a glass component, which comprises a mixture of alkali-free inorganic oxides, in which a filler component is dispersed, wherein the filler component is up to 40% by weight of the total weight of the glass component and the filler component;

applying the composite sealant mixture to a selected location of the fuel cell stack; and

transforming the composite sealant mixture to seal the selected sealant location.

[Claim 24] The process of claim 23, wherein the glass component comprises, on a mole basis, 20 to 50 % BaO, 1 to 10% Y₂O₃, 5 to 20% B₂O₃, 10 to 30% SiO₂, 3 to 35% MgO, 2 to 20% CaO, 1 to 10% ZnO, and 0 to 5% ZrO₂.

[Claim 25] The process of claim 23, wherein the composite sealant mixture is applied in the form of a paste or a tape.

[Claim 26] The process of claim 23, wherein the composite sealant mixture further comprises an organic binder material.

[Claim 27] The process of claim 23, wherein the transformation step comprises heating the sealant mixture to a temperature above the softening point of the glass component to devitrify and crystallize the glass component, transforming it into a glass-ceramic matrix in which the filler component is dispersed.

[Claim 28] The process of claim 23, wherein the seal of the fuel cell stack is effective under pressure differentials up to 5 psig.